



**BIOLOGY  
HIGHER LEVEL  
PAPER 1**

Wednesday 6 May 2009 (afternoon)

1 hour

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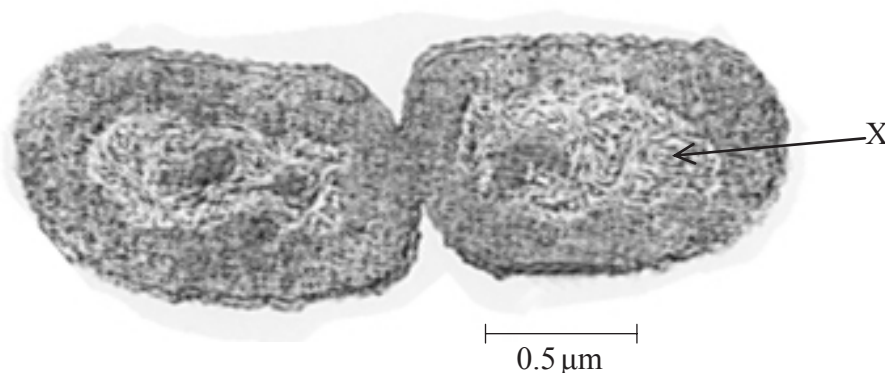
**INSTRUCTIONS TO CANDIDATES**

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.



1. The  $t$ -test is used to test the statistical significance of a difference. What is that difference?
  - A. Between observed and expected results
  - B. Between the means of two samples
  - C. Between the standard deviation of two samples
  - D. Between the size of two samples
  
2. By what process do most bacteria divide?
  - A. Mitosis
  - B. Meiosis
  - C. Conjugation
  - D. Binary fission

Questions 3 and 4 refer to the following micrograph of an *E.coli* bacterium undergoing reproduction.

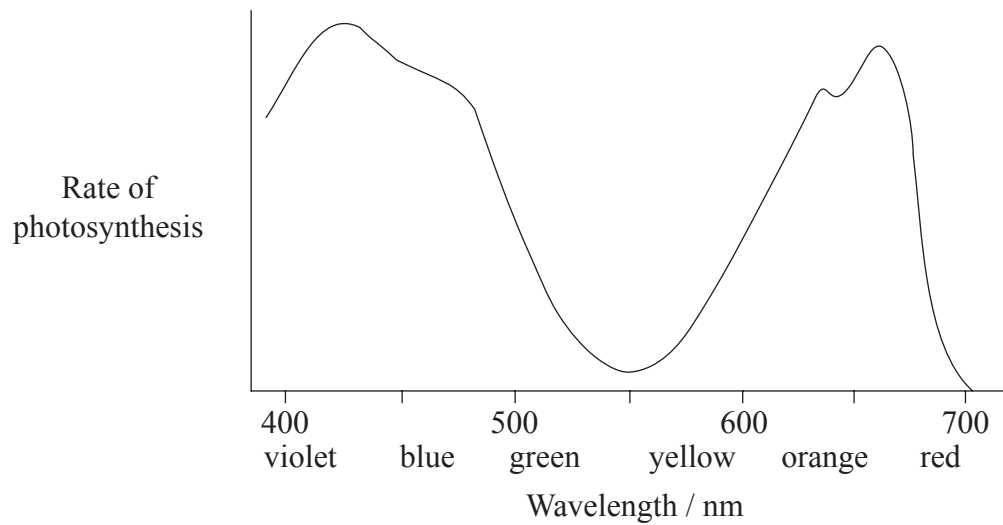


[Source: [www.bio.mtu.edu/campbell/prokaryo.htm](http://www.bio.mtu.edu/campbell/prokaryo.htm)]

3. The scale bar represents  $0.5\ \mu\text{m}$ . How long are both cells in total?
  - A.  $5.0 \times 10^{-6}\text{ m}$
  - B.  $5.0 \times 10^{-9}\text{ m}$
  - C.  $2.5 \times 10^{-6}\text{ m}$
  - D.  $2.5 \times 10^{-9}\text{ m}$

4. In the diagram what does label X identify?
- A. Nucleoid region
  - B. Chromatin
  - C. Histones
  - D. Endoplasmic reticulum
5. What is a difference between a cell in the  $G_1$  phase and a cell in the  $G_2$  phase of the cell cycle?
- A. A cell in the  $G_2$  phase would be smaller than a cell in the  $G_1$  phase.
  - B. A cell in the  $G_2$  phase would have more mitochondria than a cell in the  $G_1$  phase.
  - C. A cell in the  $G_1$  phase would have more DNA in its chromosomes than a cell in the  $G_2$  phase.
  - D. DNA replication occurs in the  $G_1$  phase but not in the  $G_2$  phase.
6. Which of the following is **true** about a polar amino acid and cellulose?
- A. Both are polysaccharides.
  - B. Both contain nitrogen.
  - C. Both are hydrophobic.
  - D. Both contain hydrogen atoms.

7. What conclusion can be drawn from examining the action spectrum for a green plant shown below?



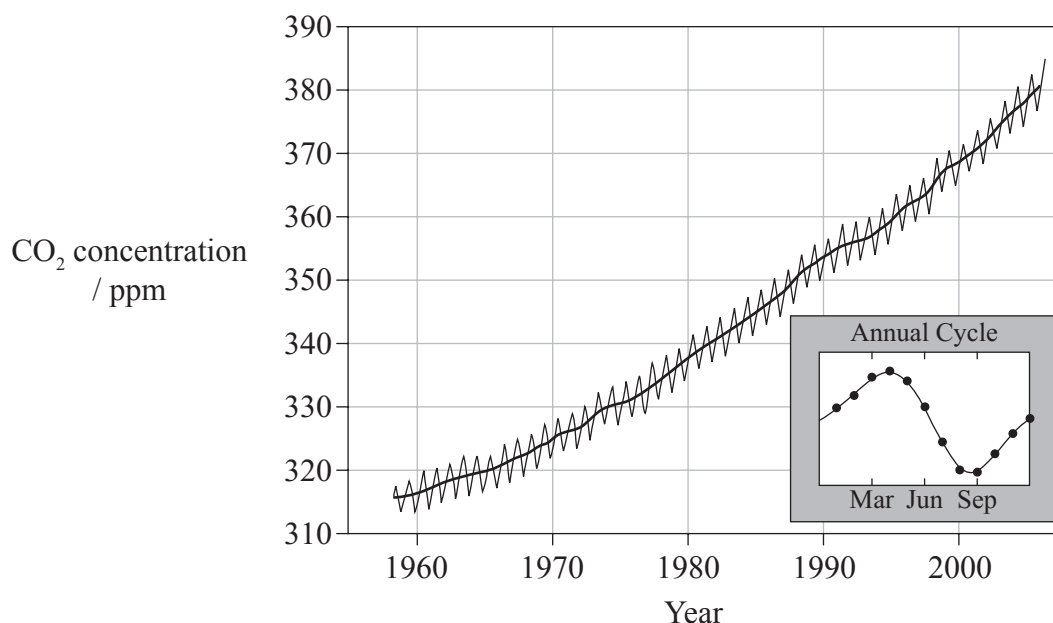
- A. Yellow light is the most effective at promoting photosynthesis.
- B. Every colour of light is equally effective at promoting photosynthesis.
- C. Light of wavelength 550 nm is least effective at promoting photosynthesis.
- D. Light in the green range is the most effective at promoting photosynthesis.
8. Where in the cell does the Calvin cycle take place?
- A. Stroma of chloroplast
- B. Mitochondrial matrix
- C. Cytoplasm
- D. Inside thylakoid
9. Blood is a water-based transport medium. Which property of water makes it a good transport medium?
- A. High specific heat
- B. Transparency
- C. Versatility as a solvent
- D. It has its greatest density at 4 °C

- 10.** If 15% of a sample of DNA is thymine, what percentage of the DNA is guanine?
- A. 15%
  - B. 30%
  - C. 35%
  - D. It cannot be determined from the information given.
- 11.** On which molecule is a codon found?
- A. Polypeptide
  - B. mRNA
  - C. tRNA
  - D. rRNA
- 12.** What do **all** human males inherit from their mother?
- I. An X chromosome
  - II. A Y chromosome
  - III. Mitochondrial DNA
- A. I and II only
  - B. II only
  - C. I and III only
  - D. I, II and III
- 13.** Which structure releases glucagon?
- A.  $\alpha$  cells of the pancreas
  - B.  $\beta$  cells of the pancreas
  - C. Liver cells
  - D. Hypothalamus

- 14.** Which muscle action is associated with an increase in the volume of the thoracic cavity during inspiration?
- A. The diaphragm contracts.
  - B. The external intercostal muscles relax.
  - C. The internal intercostal muscles contract.
  - D. The abdominal muscles contract.
- 15.** When a pathogen is ingested by a phagocyte, which event occurs first?
- A. T-cell activation
  - B. Memory cell proliferation
  - C. Antigen presentation by the phagocyte
  - D. B-cell activation

- 16.** Which of the following describes arteries?
- A. They have thick muscular walls.
  - B. They usually contain valves.
  - C. They carry blood towards the heart.
  - D. They carry blood from the lungs.
- 17.** What is the main function of the large intestine?
- A. Absorption of water
  - B. Digestion of fats and proteins
  - C. Absorption of nutrients
  - D. Recycling of digestive enzymes
- 18.** To which group do sponges belong?
- A. Cnidaria
  - B. Filicinophyta
  - C. Porifera
  - D. Mollusca

The following graph refers to questions 19 and 20. It shows variation in the concentration of  $\text{CO}_2$  in the atmosphere as measured at Mauna Loa in Hawai'i. The small inset graph shows the variations in  $\text{CO}_2$  during a one year period.



[Source: adapted from Dr P Tans, NOAA Earth System Research Laboratory]

19. What is the main cause of the increase in  $\text{CO}_2$  levels from 1960 to 2000?
- A. Burning fossil fuels
  - B. Destruction of the ozone layer
  - C. Increases in ultraviolet light penetrating the Earth's atmosphere
  - D. Reforestation
20. Why does the amount of  $\text{CO}_2$  fall between April and August?
- A. Seasonal increase in the rate of photosynthesis in the northern hemisphere forests
  - B. Seasonal decrease in the rate of photosynthesis in the northern hemisphere forests
  - C. Seasonal decrease in the rate of fossil fuel consumption
  - D. Seasonal increase in the amount of  $\text{CO}_2$  dissolved in the oceans



21. The scarlet cup fungus (*Sarcoscypha coccinea*) obtains its nutrition from decaying wood by releasing digestive enzymes into the wood and absorbing the digested products.

Which of the following terms describe(s) the fungus?

- I. Autotroph
- II. Heterotroph
- III. Saprotroph

- A. III only
- B. II and III only
- C. I and III only
- D. I, II and III

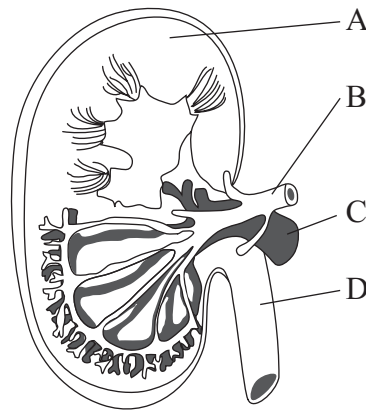
22. What could be achieved by DNA profiling using gel electrophoresis?

- A. The chromosome number of an organism could be counted.
- B. It could be shown that human tissue found at the site of a crime did not come from a person suspected of having committed the crime.
- C. A karyotype could be produced.
- D. Extinct species of living organisms could be brought back to life.

23. Which of the following conclusions did Mendel make from his experiments?

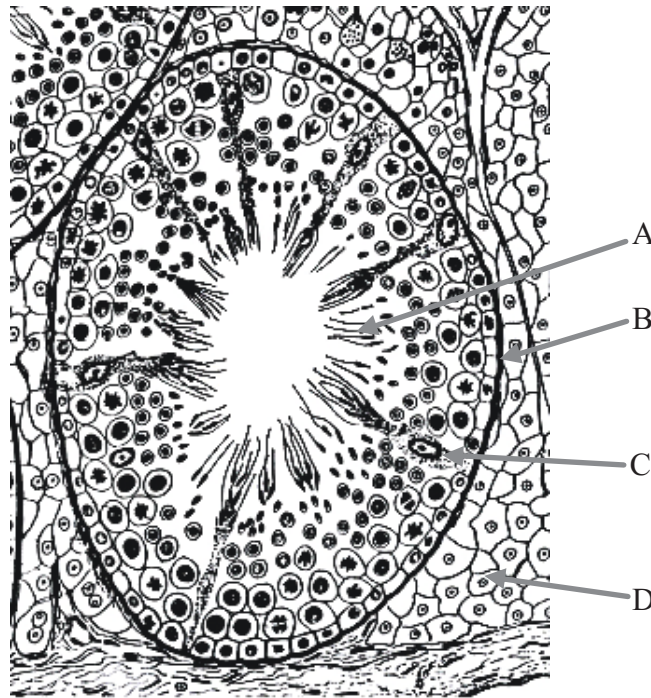
- A. Dominant genes are more frequent than recessive genes.
- B. Genes are composed of DNA.
- C. Genes for two different characteristics are inherited separately.
- D. Segregation occurs through meiosis.

24. In the following diagram of the kidney, which structure contains urine?



25. Which structure is acted upon by ADH (vasopressin)?
- A. Proximal convoluted tubule
  - B. Bowman's capsule
  - C. Loop of Henle
  - D. Collecting duct
26. What is the distinction between highly repetitive DNA sequences and single-copy genes?
- A. The highly repetitive sequences have greater amounts of guanine.
  - B. The highly repetitive sequences have greater amounts of cytosine.
  - C. The highly repetitive sequences are not transcribed.
  - D. The highly repetitive sequences are not replicated.

27. Which of the cells labelled in the diagram below provides nourishment for developing sperm cells?



[Source: Freeman & Bracegirdle, *An Atlas of Histology*, (Heinemann: 1976) p. 91, Copyright holder unknown.]

28. What is the advantage of CAM (crassulacean acid metabolism) and other adaptations of xerophytes in plants?
- A. It helps the plant to survive high humidity.
  - B. It helps the plant prevent water loss.
  - C. It helps the plant survive low light intensities.
  - D. It helps the plant survive when there are low nutrients in soil.
29. Which plant hormone is responsible for the closing of the stomata?
- A. Gibberellic acid
  - B. Absciscic acid
  - C. Phytochromes
  - D. Ethylene

Questions 30 and 31 refer to the following information.

In fruit flies (*Drosophila melanogaster*) grey body is dominant to black body and normal wings are dominant to vestigial wings.

30. If a heterozygous grey fruit fly is mated with a black-bodied fruit fly, what proportion of the offspring would be black?
- A. 0%
- B. 25%
- C. 50%
- D. 100%
31. Male flies, heterozygous for both grey body and normal wings, were mated with black-bodied, vestigial-winged females. 2000 offspring were counted. The resulting percentage of each type of offspring is shown in the table below.

Resulting offspring	Frequency
Grey body, normal wings	40%
Black body, vestigial wings	40%
Grey body, vestigial wings	10%
Black body, normal wings	10%

What conclusion can be drawn from the information given above?

- A. The genes assort independently.
- B. A mistake has been made.
- C. The genes are linked.
- D. The genes are on separate chromosomes.

32. What structure within muscle tissue is surround by membrane and has multiple nuclei?

- A. Muscle bundle
- B. Muscle fibre
- C. Myofibril
- D. Sarcomere

33. Which of the following are features of the dicotyledonous plants?

- I. Parallel leaf veins
  - II. Flower parts in groups of three
  - III. Two seed-leaves (cotyledons)
- A. III only
  - B. II and III only
  - C. I and II only
  - D. I, II and III

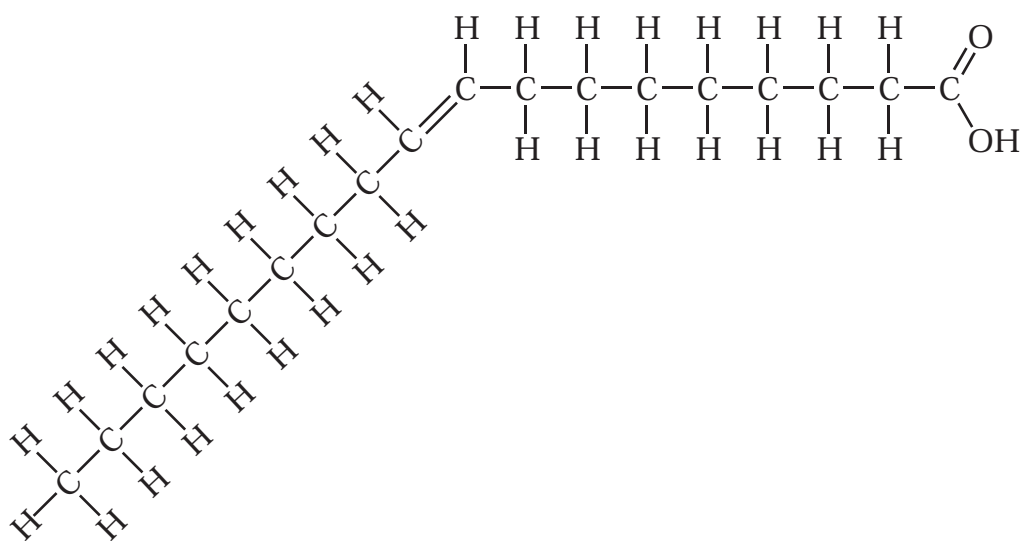
34. Which of the following statements is **true** about enzymes?

- A. They are used up in the reactions they catalyse.
- B. Allosteric inhibitors bind to the active site.
- C. They lower the energy of activation for a reaction.
- D. They supply the energy of activation for a reaction.

35. Which of the following is **not** a function performed by a membrane protein?

- A. Hormone binding sites
- B. Cell adhesion
- C. Enzyme synthesis
- D. Pumps for active transport

36. Which chemical is shown in the diagram below?

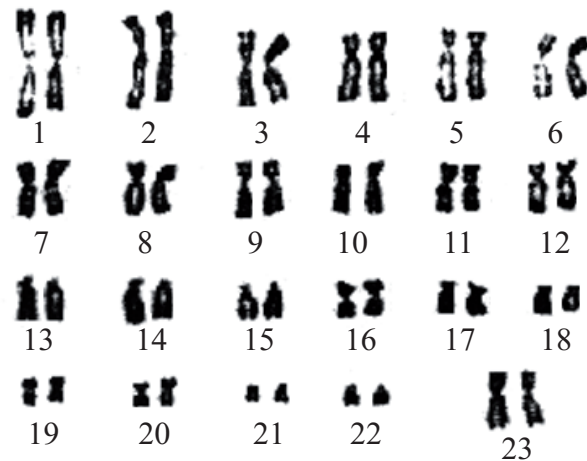


- A. Monosaccharide
- B. Triglyceride
- C. Fatty acid
- D. Amino acid

37. Which of the following chemicals is a component of eukaryotic chromosomes?

- A. Protein
- B. Triglyceride
- C. Fatty acid
- D. RNA

Questions 38 and 39 refer to the following karyotype.



[Source: [www.ds-health.com/trisomy.htm](http://www.ds-health.com/trisomy.htm)]

38. What procedure(s) could have been involved in the creation of the karyotype?

- I. Chorionic villus sampling
- II. DNA profiling
- III. Amniocentesis

- A. I only
- B. II only
- C. I and III only
- D. I, II and III

39. What can be concluded from the karyotype provided?

- A. There was non-disjunction during meiosis in the mother.
- B. There was non-disjunction during meiosis in the father.
- C. The fetus is male.
- D. The fetus is female.

- 40.** Which of the following is an inherited disease that is due to a base substitution mutation in a gene?
- A. Trisomy 21
  - B. Sickle cell anemia
  - C. AIDS
  - D. Type II diabetes
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